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AUTHOR Kerwood, Robert V.; Starsen, Melle
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ABSTRACT

This project was conducted to determine how best to serve the needs of rural vocational education students in Arizona. The study examined the literature on delivering instruction in such a manner that graduates of all vocational programs have equal opportunity, equal access, and equal competitiveness in the marketplace. Problems in supplying vocational education in rural areas were identified. Twelve methods of ensuring quality in instruction to rural education were explored (mobile units, consolidation, interactive television, one-way televised instruction, microcomputer-mainframe network, satellite computer-based instruction, full network, audio teleconferencing, videotaped lessons, interactive video, regional vocational training centers, and resource sharing), with advantages and disadvantages determined for each method. In addition, the advantages and disadvantages of distance education were discussed. The project concluded with recommendations for rural vocational programs in Arizona to use as many types of media as possible to provide education--considering it cheaper to transport information than people--and to provide model programs for the areas being served. (KC)

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SHOULD WE CHEAT THE RURAL VOCATIONAL EDUCATION STUDENT?

Model Programs for Rural Vocational Education

by

Dr. Robert V. Kerwood and Melle Starsen
Arizona Center for Vocational Education

Arizona Center for Vocational Education

Northern Arizona University

Flagstaff, Arizona 86011

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FORWARD

Model Programs for Rural Vocational Education was funded in October, 1987, to provide research and recommendations for the direction of Rural Vocational Education in Arizona. A number of recommendations for short-term and long-range modifications in rural school districts have been made, along with specific recommendations for the involvement of Boards of Education and business and industry.

A frequent and sometimes heated debate has been stirring for some time around the topic of rural versus urban vocational education. Is there a real difference between the vocational education offerings? The documentation found in the literature of this project says yes, and there are wide gaps between rural and urban resources for vocational education.

Is it fair for rural vocational education students who are preparing for the future workforce to receive less than comparable urban instruction in their community setting? How does a state marshall its resources to narrow the gap of competence for the technological advances of the future?

This study examines the literature of how to effectively deliver instruction in such a manner that graduates of all vocational programs have equal opportunity, equal access, and equal competitiveness in the marketplace. Further, the recommendations address a comprehensive approach to rural vocational education in Arizona which will narrow the gap.

Robert V. Kerwood, Ph.D.
Project Director

Melle Starsen
Project Researcher and Writer

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8. Higher per student costs than in urban areas
9. The inability to finance expensive support systems
10. Lack of a sense of the future
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    6. Attitude and image

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    2. Consolidation
    3. Interactive Television
        a. Low Power Television or sideband
        b. Cable
        c. Microwave
        d. Interactive Television Fixed Service
        e. Fiber optics
        f. Compressed video
    4. One-way Televised Instruction
    5. Microcomputers-Mainframe Network
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    8. Audio Teleconferencing
    9. Videotaped lessons
    10. Interactive Video
    11. Regional Vocational Training Centers
    12. Resource Sharing

E. Distance Education - Advantages
    1. Better serves educational needs of students
    2. New courses become easily available
    3. Replaying capabilities
    4. Eliminates costs and time of travel
    5. Better utilizes faculty expertise
    6. Variety of courses and times offered
    7. Spirit of cooperation fostered
    8. Interdisciplinary communication developed
    9. Students gain needed experience on equipment
    10. Schools' events involvement

F. Distance Education - Disadvantages
    1. Competition
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    3. Effect on Students
    4. Preparation of teachers

IV. Recommendations:

A. State programs of rural vocational education should include and consider the following:
    1. State programs of vocational education must assist the rural programs with:
        a. Information and funding
        b. Coordinated efforts of projects
        c. Determining accreditation
        d. Working with the universities
        e. Alleviating the concerns of teachers
    2. The idea that information is cheaper to transport than people.
    3. The development of a comprehensive delivery system which includes as many different forms of media as possible.
    4. Model programs which are customized for the area being served.
    5. Strong curriculum phases before programs are implemented.
    6. Continuous research regarding new and emerging technologies and programs.
    7. A solid system of distance education.
    8. Programs to fit individual areas.
    9. The teaching of technology, not toys.

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SHOULD WE CHEAT THE RURAL VOCATIONAL EDUCATION STUDENT?

INTRODUCTION

Why should the vocational education student in a small, isolated rural town be cheated out of the same quality education and preparation for a career as his or her urban counterpart simply because of where he or she lives?

While the challenges to American youth are serious enough when confronting the workplace of the future, they are even more serious in terms of rural youth. Not only are the sources of information about technology and systems of communication less available to rural youth than their urban counterparts, but so is the diffusion of new forms of technology and their utilization. And their importance is not nearly so obvious outside of metropolitan areas.

The purpose of this study was to delineate the problems and establish a plan for the development of a new direction in rural vocational-technological education in Arizona. The proposed recommendations were responsive to a number of key challenges to education in Arizona, (particularly the disproportionate numbers of at-risk and Limited English Proficiency youth who reside in rural Arizona) and can provide a model for the training of rural youth nationwide and their preparation for the workplace of the future.

OVERVIEW

One of the most difficult problems facing educators today is the attempt to predict the educational needs of the future. This is particularly true in the area of vocational education, where the existing predictions are already gloomy at best. Many critics and supporters alike are predicting the demise of vocational education as a viable subject matter due to the "back to basics" movement which currently pervades the American education system. These critics are calling for a return to basic skills - the three R's, or perhaps more appropriate for the future, the two C's: computers and communication skills. Francis Tuttle, (1988) President of the American Vocational Association, adds two more C's to that list: computation and critical thinking.

Many vocational educators view this return to basics movement as a challenge to devise a broad spectrum of applicable abilities that cut across many different fields; that is, an integrated curriculum, which includes traditional academics and the new vocational training for the 21st century. But this still doesn't answer the critics of vocational education.

In his article, "Educating Students for Life After High School - Where Does Vocational Education Fit," (1985) Ted Urich asks:

> What kinds of learning have the most potential for transfer? The answer seems to be those concepts which have the highest generalizability, the basic tools of learning--science, mathematics, communication skills, and the social studies.

Urich would have us believe that "a limited repertoire of vocational skills...will be almost useless" in the New Age of advanced computerization, data filing, telecommunications, and a wide variety of other technology-based changes that have been unanimously foreseen. But Urich speaks of skills that are already outdated, even by traditional vocational education standards: typing, filing, shorthand, and bookkeeping. He also refers to "shop," a term which is archaic at best.

It could be that Urich asks the wrong questions with regard to the future role of vocational education.

In his book, Beyond Conventional Wisdom, (1977) Jonathon Sher disagrees with Urich and states, "The need for vocational training, nationally, is unquestionable." The question then becomes, How? In what ways should vocational education adapt itself to the needs of the future? The critics of vocational education are correct in one of their ideas: vocational education will absolutely need to adapt to the changes in technology, or it might well become obsolete before the end of this century because of the driving force of the back to basics movement. But a significant question arises at this point: what are the new basic skills? According to Cetron and Appel (1984) the basic skills of the future will be:

-learning to read & write effectively
-learning to communicate simply
-learning to manage information
-learning computer literacy
-learning history
-learning to think
-learning to learn.

The future employer will be looking for an employee who can learn, think, solve problems, and handle a computer with ease. The most valued skill will be the ability to use a core of skills in a variety of tasks.

Naturally, the most important question then becomes, can instruction of these basic skills of the future somehow be integrated into vocational courses? Is there a practical way to incorporate the teaching of "occupational versatility" into vocational training classes? Why not transfer typing, filing, bookkeeping, etc. to the new skills of computer literacy, electronic bookkeeping, etc, and make vocational education

applicable to the new technologies? The core skills are the same, i.e., literacy with numbers, credit and debits, and so on. Instead of teaching "shop" and filing, one possibility would be to instruct vocational education students in the uses of talking typewriters and the repair of the new computerized automobiles.

According to Willard Daggett, in 1981 the Instructional Futuring Committees created a core of competencies that they felt all graduates of instructional programs should possess. These core skills and knowledges were classified into five groups as follows:

1. Personal Development
   - -personal skills
   - -self-concept
   - -personal appearance
   - -use of leisure time
   - -interpersonal relations
   - -participation and interaction with groups and organizations
   - -career awareness/exploration
   - -goal setting/career planning
   - -job retention
   - -employer and employee relations
   - -health
   - -adaptability
   - -social skills
   - -decision making
   - -problem solving
   - -leadership
   - -job application
   - -job progression
2. Social Systems
   - -economic concepts
   - -legal literacy
   - -political literacy
3. Information Skills
   - -nonverbal communication
   - -written communication
   - -reading comprehension
   - -information retrieval
   - -dictating communication skills
   - -verbal communication
   - -listening
   - -computation
   - -keyboarding skills
   - -use of information
4. Resource Management
   - -money
   - -natural resources
   - -consumer skills
   - -time
   - -human resources
5. Technology
   - -concepts of technology
   - -applications of current and emerging technologies
   - -use of basic tools and equipment
   - -personal safety
   - -work related safety

According to Daggett, the core group skills were implemented into the New York school system in 1986 with extremely positive results. The only problems that became apparent were 1) everyone agrees these skills should be taught, but what areas do you give up to make room for them? and 2) the inability of the occupationally prepared teachers to teach these core skills.

Another such core group skills program is currently being tested in 13

southern states which belong to the Southern Regional Educational Board (SREB.)

Gene Bottoms, director of the SREB Consortium, (1988) said the project was designed, in part, as a response to the stricter academic requirements adopted by states in recent years. These mandates have left many students with little time to take vocational courses. According to Bottoms:

> A major goal of the project is to help students enrolled in vocational education realize that academic competencies--the ability to read and comprehend with ease, to calculate accurately, and to apply this knowledge to solving problems--are essential for success in today's rapidly changing workplace.

The program will test Spring 1988 vocational education completers using the National Assessment of Educational Progress (NAEP) to evaluate their reading, mathematics, and science skills. After assessing how well the current course of study is preparing these students academically, subsequent annual tests will be given for the next five years to assess whether the new approaches are having a positive effect.

Archie E. Lapointe, (1988) executive director of NAEP, called SREB's project "perhaps the most important and ambitious undertaking in the vocational field in a great many years. It may well pave the way for improvements throughout the nation."

The end result of the project will be to provide vocational program graduates with more sophisticated preparation so they will be able to continue learning in their workplace or additional educational settings.

True to the objective of SREB's program, vocational education is today mirroring the theory versus application debate. There are currently two discernible trends emerging in vocational education:

1) Technology: that is, the mechanical aspect, the ability to do things, once termed "psychomotor skills," used in lab courses.

2) Science: the knowledge needed before technology can take place.

Obviously the missing element here is interpersonal human skills, also known as the "affective domain." This has not traditionally been an area that vocational educators have been very concerned with in the academic setting. [Tangentially, these are worked on with student youth groups.] In order to fully integrate Technology and Science that the SREB program is concerned with in the world of work, human relations skills will have to be inculcated into secondary and perhaps even elementary

programs. That is, if students are going to have any chance at all to compete in the work world of the future according to Cetron (1986) and other futurists.

What all of this comes down to is a new area of competencies, which we will call BASIC VOCATIONAL EDUCATION SKILLS. These must be defined, set up for each vocational training area, pilot tested and implemented. Consideration must also be given as to how they apply to every subject area. In some ways, they should be similar to skills in other areas, but specifically applicable to vocational areas as well as academic.

One of the most important problems in implementing a new system is student motivation. Learning new tasks can be frustrating to students, especially when the new tasks seem abstract and have no applicability to real life. One of the ways to alleviate this particular problem is to illustrate to students how theory and application go hand in hand. For example, basic arithmetic skills are used in such areas as autobody, carpentry, drafting, food preparation, and welding, to name just a few. (Shelby and Johnson, 1988) Learning computer operations may seem to students like an abstraction at first, but they will need to learn that computers already have concrete applications in everything from agriscience to health technology. (See Competency chart [Appendix B] from Shelby and Johnson.) The world is becoming more inter-related (Theobald,1985) and the world of education must follow suit.

According to Robert Miller (1988), the "tissue paper" theory affects the learning process of students and adults. The theory is that information crammed at length into a learner's mind leaves very quickly, as though it were written down on tissue paper, which is destroyed quite easily. (This can also apply to how quickly knowledge changes in our society and what is learned today will be obsolete tomorrow, as though it were written on tissue paper.) What vocational education should be concerned with is how to get past the dangers of the tissue paper theory by teaching the basic skills of LEARNING HOW TO LEARN. Learning how to learn thus applies to vocational education as well as any other area, perhaps even more so since vocational education has more changes to incorporate than some other areas of mainstream education. And since it is in more danger at present of being pushed aside in favor of strict academics.

One way of combating the tissue paper syndrome is to use "spiral curriculum," which is completely student-centered instead of being school-centered or teacher-centered. The spiral system is almost 100% student-centered and encourages the student to learn in circular patterns which reinforce learning instead of requiring step-by-step processes that tend to reinforce the learn-and-forget pattern so common to most educational systems.

Are there any other methods to accomplish this? Vocational Education is currently scrambling to be part of the back-to-basics

movement. However, at the moment it seems to be too little, too late. Eleventh and 12th graders are hurriedly being taught skills that they should have been introduced to in the 7th grade at least. One possible solution is to test students as soon as they enter the program to discover their levels and work from there. The earlier the better. And with the new age of technology, and the insistence by some experts that human relations skills are going to be in great demand, these tests should not only include math, science, and applicable vocational areas, but interpersonal skills as well. Since service industries are going to be the mainstay of the next century, other skills such as extrapolation of information, analysis, decision making, and problem solving should be emphasized as well.

This brings us to the question of assessment in these new areas of competency. One pattern of Basic Skills assessment could involve a two-pronged concentric circle approach: 1) make a detailed list of each area's competencies and put the lists into large circles; then 2) go back to where the circles of different areas meet and find clusters of competencies that areas have in common (See Appendix A.) After being defined, common basic skills could then be incorporated into basic vocational skills course plans.

The name of the game for the future of vocational education is integration and cooperation. Cooperation between vocational education and academic areas and learning about each other's areas is vital. (Shelby & Johnson, 1988) This includes not only cooperation between vocational education and mainstream education, but between vocational education and business and industry, community groups, and parents. Integration will have to occur if vocational education is to have a healthy future. Vocational education will have to take a long, hard look at itself and solve some of its internal problems such as high teacher turnover and outdated programs. And since the future is already upon us in some areas, the planning stages should already be in effect.

THE RURAL EDUCATION "PROBLEM"

The problems in the delivery of vocational education in rural settings, as indicated by nearly all of the available literature, are inter-related and concentric, and stem from similar basic difficulties.

According to Hobbs (1985), the most significant problem in rural vocational education now and in the future is: "To be able to take advantage of quality educational technology resources, in a cost effective way, that fill a specific curriculum need, but are located somewhere else."

Charles Doty, Rutgers-State University of New Jersey, assesses the main problem as "money." (1988) Doty discusses the fact that more and more people are leaving the rural areas which in turn puts more pressure on the already weakened tax base. He predicts that in the future, rural area

community colleges will significantly reduce experiential technical programs and may close altogether. Doty cites as evidence of this trend the fact that as of January 1987, 1,068 community colleges were in existence, down from 1,280 seven years earlier.

On the other hand, Sullins (1987) sees the most important problem as a lack of a sense of rural awareness on the part of the nation - a lack that "has led to assignment of inadequate attention and resources to rural education." Sullins also lists the following as significant impediments to quality vocational education in rural areas:

-extensive travel
-high poverty potential
-lack of cultural resources
-lack of adequate monetary resources
-higher per student costs than in urban areas
-the inability to finance expensive support systems such as shops, labs, libraries, and special equipment
-lack of a sense of future

Rosenfeld (1980) lists sparse population, distance from centers of commerce and industry, and deep rooted values and traditions as the major stumbling blocks to revitalized vocational education in rural areas.

And the nature of vocational education is itself a problem, according to Edington (1980); because vocational education is so specialized, the requirements are normally quite specific and to have enough students for these very specific programs, greater numbers of students are needed than are found in many of our rural isolated areas. Related to this is the fact that small rural schools have insufficient enrollments to permit a full range of curricular offerings on a continuous basis. (Siegmund 1985)

Public opinion can also play a decisive role in the development of new and innovative programs. Edington (1980) relates the sad example of a situation in Hancock County, Maine, where a new $1.5 million area vocational center sits empty because leery citizens have thus far refused support.

REVIEW OF THE LITERATURE

Rural Vocational Education

In the face of crises such as have been described in this paper, experts agree that the goal of vocational educators and administrators should be to create effective model programs for rural areas, with the future in mind, especially in the areas with the highest predicted growth,

such as Advanced Manufacturing (including robotics), Business Office Technology, Health and Biological Technology, Micro-Electronics Technology, Computer Applications, Telecommunications, Family Life Management, and Distance Education.

And in addition to the problems that mainstream vocational education faces, rural vocational training is further beset by difficulties arising from six main areas as follows:

1) access and delivery systems
2) outdated programming
3) job market relevancy
4) migration patterns
5) lack of local job experience opportunities
6) attitude and image (Jonathon Sher, 1977)

Access and Delivery Systems. Traditionally, there have been two basic delivery systems common to rural school systems. Students in the larger, more comprehensive schools receive vocational training on the spot, within their local vocational education programs. Students in smaller, isolated schools, however, are very often required to commute to larger schools, or more commonly, to regional vocational training centers, (Sher, 1977) which are often so far away that the students are sometimes forced to either move away from home, or commute on a weekly basis.

Outdated Programming. Too often when programs are offered in the larger, more comprehensive schools, they tend to be archaic at best. In the past twenty years, rural America has been subject to a mind-boggling set of changes including the rise of agri-business, mass migration of populations, and the closing of millions of small farms. Hence, the trend from production agriculture to agri-business emphases is a welcome transition in vocational education.

Relevancy. Not only does the outdated programming leave students unprepared for work in rural areas, it also leaves them without proper skills for work should they decide to move to urban areas. However, educators must consider what Edington calls the "myth" of rural education, that is, it is a myth that we need to train rural students only for work in urban areas. According to Edington, (1980) rural youth really do prefer to stay and work in their own rural communities. Of course, this is dependent upon the condition described below, availability of economic opportunities.

Migration. Unhappily this pattern of trying to prepare students for work in their own rural areas becomes a vicious circle. When there is no work for them, they tend to migrate to urban areas, and thereby remove even more potential work force from the rural settings. This adds to the economic decay of the rural area and the cycle is continued. Some educators have designed so-called "progressive" programs that work from the assumption that vocational programs should purposely aim at educating

students for high tech skills in urban areas. This design precludes any notion of revitalizing rural areas. According to Sher (1977):

> A vocational education strategy geared toward producing rural migrants is not only bad policy, but also a cruel deception. Passing the buck to urban American is a far cry from solving the problem of unemployment among rural youth.

Lack of Local Job Opportunities. Related to the migration factor is the fact that the more students who migrate, the less likely rural businesses are to flourish And the more this cycle occurs, the less likely that other up-and-coming vocational education students are to find local work experience because the businesses involved have already failed. This is another circular pattern that is spiraling downward, toward the destruction of rural settings as viable parts of the American economy.

Attitude and Image. Finally, add to all of this the problem of vocational education's image in general. According to the National Advisory Council of Vocational Education (1988):

> At the very heart of our problem is a national attitude that says vocational education is designed for somebody else's children. The attitude is shared by businessmen, labor leaders, administrators, teachers, parents, and students. We are all guilty. We have promoted the idea that the only good education is an education capped by four years of college. This idea, transmitted by our values, our aspirations, and our silent support, is snobbish, undemocratic, and a revelation of why schools fail so many students.

It is imperative that vocational educators and administrators seek out alternative models as solutions to these problems by using some of the following plans for model programs. It is important to realize that only by involving community support, input from parents, and the teaching of critical thinking skills, problem solving skills, and the ability to learn, will vocational education in rural areas be able to supply much needed instruction and training in the next century.

In the case of access and delivery, for those students who desire vocational training but who live in extremely remote or isolated areas, sometimes the time, energy and cost of commuting to a distant school or regional facility outweighs the benefits. In many cases, the student who desparately needs vocational training is the very one who doesn't receive it

because he is simply too far away from the training center.

There are currently twelve distinct methods of supplying vocational training and instruction to isolated rural areas, as follows:

1) Mobile facilities units
2) Consolidation
3) Interactive Television
   a. Low Power Television (or sideband television)
   b. Cable
   c. Microwave
   d. Interactive Television Fixed Service
   e. Fiber optics
   f. Compressed video
4) One-way televised instruction
   a. live ("candid")
   b. scripted and pre-produced
5) Microcomputers-Mainframe network
6) Satellite computer based instruction
7) Full Network
8) Audio teleconferencing
9) Videotaped lessons
10) Interactive video
11) Regional vocational training centers.
12) Resource Sharing

A. <u>The Mobile Facilities Center:</u> delivering instruction with the use of a mobile classroom, similar to the units used in the model program that was tested in South Dakota in the mid and late 1970's, and early 1980's. The program in South Dakota initially took instruction to rural areas using three self-contained mobile units. The purpose of the program, according to the South Dakota final report (1986), was:

> ...to assist local schools in preparing students with better job skills and work attitudes, and for further education. Programs were selected to assist the 60 to 80 percent of the students in member schools who did not go on to college.

Each of the first three mobile units was 12x60' and could accomodate up to 12 students in each of 3 occupational training programs, for up to a total of 36 students. The plan was that each of the mobiles would spend four and one-half months in each of the 10 schools, and provide instruction and training in the following areas:

> General Metal, Building Trades, Electronics/ Electricity, Quantity Foods, Auto Mechanics, Ag. #1 Animal Science, Health Occupations, Sales/Distribution, and Ag. #2 Crop Science.

Advantages

1. Such projects give students in isolated rural areas the chance to experience and work with modern up-to-date equipment which would probably not have been available in their own school programs. (South Dakota Final Report, 1986)
2. Can provide a wide range of courses that wouldn't be available to the students. (South Dakota Final Report, 1986)
3. Mobile units are very convenient in that the students do not have to travel great distances and can fit the the sessions easily into their schedules because of the multiple offerings. (South Dakota Final Report, 1986)

Disadvantages

1. One of the biggest problems is teacher turn-over, which is one of the difficulties that vocational education has been dealing with for years. In the case of the mobile units program, the normal motivations for staying with a school--tenure, working relationships with other teachers, helping the program grow and develop--were missing, since the teachers spent only one semester in each school and then moved on to another school. (South Dakota Final Report, 1986)
2. Some of the participants in the program expressed frustration with the above, saying that it would be virtually impossible to have any family responsibilities and have to move every four and one-half months. (South Dakota Final Report, 1986)
3. Another problem cited was the high start-up cost of the mobile units themselves. The initial three units were purchased from an educational supply firm in 1973 and cost $157,146. However, when the second three units were purchased, the governing board of the school district opted to design the units internally, and to purchase them from a different company; the cost of these second units, which were 14x60' in size, was $40,635. (South Dakota Final Report, 1986)

The 1988 cost of similar units (12x60) would be approximately $49,500.

B. CONSOLIDATION: closing smaller schools and combining school populations into larger, more regional schools or centers.

Advantages

1. Increases the resource and student base (Hobbs, 1985)
2. Expands educational offerings (Hobbs, 1985)

Disadvantages

1. Social losses to communities that lose their schools (Hobbs, 1985)
2. Increased travel costs, lack of public support (Hobbs, 1985)
3. Usually leads to counterproductive controversies (Brach, 1984)
4. The separation of a school from its constituant community causes a rural area to lose a significant portion of its local identity (Brach, 1984)
5. As school districts are thus centralized, a sizeable portion of the adult population that participates in school related activities is lost. (Brach, 1984)
6. Transportation costs are high (Brach, 1984)
7. Students lose out: little opportunity to interact with teachers and peers; less time for extracurricular activities (Brach, 1984)
8. Fulfilling increased graduation requirements is harder to achieve because of the time it takes to travel back and forth (Brach, 1984)
9. Individualization of the small school is lost (Edington, 1980)

C. INTERACTIVE TELEVISION: the interconnecting of multiple school locations; designed to allow one teacher or teaching location to broadcast instruction to many other sites and allow students to interact or communicate with questions, usually via a phone line linked to the teaching site. Each classroom is potentially capable of receiving every other classroom audio and video.

Advantages

1. Allows schools to offer a wide range of elective courses. (Kitchen, 1987)
2. Permits students greater access to subject matter (Kitchen, 1987)
3. Requires cooperation among schools which eventually leads to improved programming (Kitchen, 1987)

4. Students enjoy learning on ITV and are motivated by it. (Kitchen 1987)
5. Creates interest and stimulates responses (Lundgren 1985)
6. Fosters cooperation among participating schools (Wall 1985)
7. Adult educational possibilities (Wall, 1985)

The two-way televised system alleviates the problem of classroom control by allowing for normal, one-to-one interactive communication between teachers and students. The system remains relatively the same in terms of equipment and set-up, except that classroom and teacher are linked by a telephone line. This allows those students who have questions to communicate directly with the teacher.

Disadvantages

1. Teacher control over the remote classroom is quite essential (Dean, 1986)
2. Teachers require much retraining (Kitchen, 1987)
3. Can be very expensive (Wall, 1985; Kitchen, 1987)
4. Faculty fears of being able to control remote students (Wall, 1985; Lundgren, 1985)

a. LOW POWER TV (LPTV): television signals on the low end of the power band, often called "sideband"

Advantages

1. Can be received by any home TV in range, so the home-bound or ill students can keep up with lessons (Hobbs, 1985)
2. High degree of academic success (Wall, 1985)
3. Possibility of expanded community use (Wall, 1985)
4. Inexpensive; low construction and maintenance costs (Dean, 1986)
5. Signal can be picked up by normal TV set (Dean, 1986)

b. CABLE: multiple signals carried on coaxial cable

Advantages

1. Part of an evolving telecommunications milieu that can include computers, automated office equipment (Brach, 1984)
2. Access to established lines is free to educational institutions (Dean, 1986)
3. Inexpensive modulator is all that is needed for this system (Dean, 1986)

Disadvantages

1. Access is often free but limited to certain times and/or channels (Dean, 1986)

c. MICROWAVE: signals through open space, on a line of sight path using antennas or high towers much like radio signals; provides a much faster transmission rate than is possible with phone lines or coaxial cables; long distance microwave can be set up using a system of relays, 30 miles apart

Advantages

1. Could turn an isolated rural school into a mini broad-cast studio; two-way, high quality picture, audio and computer data transmission. Versatile, inexpensive to operate and maintain (Brach, 1984)

Disadvantages

1. Complex to design and extremely expensive to initiate (Brach, 1984)

d. ITFS (Interactive TV Fixed Service): high frequency microwave signal; a certain number of bands were originally set aside by the FCC for educational purposes only; a special convertor is needed for normal television reception.

Advantages

1. Relatively inexpensive (Dean, 1986)

Disadvantages

1. Receiving sites must be located within line-of-sight of the transmitter (Dean, 1986)
2. President Reagan de-regulated high frequency microwave bands and commercial concerns have been buying frequencies and selling them back to educational institutions; therefore, according to Jay W. Dean, most of the licenses in this special band have been bought out in the last two years and very few are now available for educational use; and even if few do exist, the prevailing fee may be high. (Dean, phone interview, May, 1988)

e. FIBER OPTICS: a system that converts data, sound or images into light impulses which are then

propelled by laser along a thin glass or plastic thread at extremely high speeds. Many of these threads are then bundled together and buried in the ground or hung from wires much the same way as telephone links are treated.

Advantages

1. Can link many school buildings (Dean, 1986)
2. Can be installed using existing power or telephone lines (Dean, 1986)

Disadvantages

1. Still fairly expensive, especially for ling distances (Dean, 1986)

f. COMPRESSED VIDEO: supplying video at high speed.

Disadvantages

1. Jerky, muddy picture; expensive; bad resolution for any graphics (Dean, 1986)

D. ONE-WAY TELEVISION: The instructor delivers the lessons at his or her main transmitting site, and the signal is received by all the schools in the particular network.

a. Live or "candid" - broadcast as the course is occuring

b. Pre-produced - set up and produced specifically to be broadcast at a later date

Advantages

1. Quality instruction can be delivered on a national basis (Lundgren, 1985

Disadvantages

1. Creates boredom and frustration among students (Lundgren, 1985)
2. Students cannot ask questions or respond (Lundgren, 1985)

E. MICROCOMPUTERS NETWORKED TO MAINFRAME: desktop microcomputers connected to a mainframe. Can either be used internally (in the school) or connected to other districts and institutions by phone lines and a modem, satellite, or microwave.

Advantages

1. On-desk storage capacity is good (Wall, 1985)

Disadvantages

1. Establishment costs are high (Wall, 1985)
2. Software availability is low (Wall, 1985)

F. SATELLITES: various network systems are possible. Can be computer linked to main system via satellite bounce-off signal; possible video adaptions or phone line involvement. Can delive pertinent vocational education instruction to rural areas with the use of a satellite computer-based network which could link isolated schools with a large databank located in a eastern seaboard or midwestern city.

One of the examples of this kind of system is NovaNET, which is a state-of-the-art satellite transmitted computer-based educational system and communications network. NovaNET features user friendly, programmed lesson materials and over 17,000 hours of educational software in over 150 subject areas which can accomodate different rates and styles of learning.

The fee for a system like NovaNET system used to be quite high. Critics will most likely complain about this high cost as prohibitive and wasteful. However, there are two factors to consider in the cost of a satellite computer-based instructional system. First, the cost of NovaNET has DECREASED by 90% since the system began; today, the cost for one terminal (of 16 in a site) is approximately 59 cents per hour. Secondly, just how wasteful is it to go on buying outdated equipment in order to train students for jobs that very likely will not exist in another ten or twenty years? A review of the literature suggests that **a little more spent on education now will more than outweigh the exhorbitant expense of retraining in the future.**

Advantages

1. Amazing global coverage (Hobbs, 1985)
2. Will grow in numbers and in range of capabilities and services (Brach, 1984)
3. Not limited by line-of-sight as microwave is and can therefore reach people outside microwave range (Brach, 1984)
4. The distance between the sender and the receiver does not matter (Dean, 1986)
5. Support services are comprised of counseling, transportation, job placement and referral services (Arizona Department of Education, 1988)
6. Youth receive on-going feedback regarding their progress (Arizona Department of Education, 1988)

7. Youth can participate in "Personhood," a course designed to expand self-awareness and to assist youth in understanding the impact of their behaviour and decision making will have on their future success (Arizona Department of Education, 1988)

Disadvantages

1. Requires significant upfront investments for software and hardware as well as highly dedicated teachers and administrators who are willing to take risks (Wall 1985)
2. Uplink facilities remain expensive (Dean, 1986)
3. Needs uplink at each location to achieve 2-way TV (Wall, 1985)

G. FULL NETWORKING: uplink satellite combined with specifically designed computer programs, textbooks and call-in assistance for users; also includes communication between sites via electronic mail.

Advantages

1. Courses have clear competency based objectives (Hobbs, 1985)
2. State boundaries are no barriers (Hobbs, 1985)
3. These projects are planned with the future in mind (Hobbs, 1985)

Disadvantages

1. Takes at least one year to design (Hobbs, 1985)

H. AUDIO TELECONFERENCING: multi-wire dedicated phone line system which links locations using a bridge to set up conference calls.

Advantages

1. Phone can also use cables, switches, terminals, and computers when expanded (Brach, 1984)

Disadvantages

1. The bridge is very expensive (Wall, 1985)
2. Must use rented phone lines (Wall, 1985)

I. VIDEOTAPED LESSONS: like one-way television, these lessons can either be taped as they occur ("candid") or can

be taped much in the same way a documentary program is taped, i.e., with a script or prepared production.

Advantages

1. Cost effective (Wall, 1985)
2. Increased quality of instruction and ability of students to stop and replay sections of lessons (Wall, 1985)
3. Preproduced tapes allow for higher quality of presentation (Wall, 1985)
4. Candid tapes are even cheaper (Wall, 1985)

Disadvantages

1. Offers no opportunity for two-way communication between students and instructor (Wall, 1985)
2. Preproduced tapes can be very expensive to do (Wall, 1985)
3. Candid tapes aren't as high quality (Wall, 1985)
4. Distribution costs of getting tapes to students in a timely manner are high (Wall, 1985)

J. INTERACTIVE VIDEO : blending microcomputers with video storage units, i.e., using pre-recorded tapes or video discs with computer technology. (Wall, 1985)

Advantages

1. Allows learning to be controlled by student performance (Wall, 1985)
2. Schools already with computers have half the system (Wall, 1985)
3. Can be updated quite easily as needed (Wall, 1985)

Disadvantages

1. Still a bit expensive (Wall, 1985)
2. Lack of availability of programming; high development costs; confusion of competing technology standards (Wall, 1985)
3. Discs: lack of standardization means limited courseware is now available (Wall, 1985)

K. REGIONAL VOCATIONAL CENTERS: similar to the consolidated school in that such centers normally attempt to draw students from a wide rural area in order to centralize vocational training; often state funded and certified; the focus of such centers is usually concentrated vocational instruction.

Advantages

1. Provide rural industry with a trained labor pool (Rosenfeld, 1980)
2. Help to draw new businesses into rural areas and thus secure new jobs for graduates (Rosenfeld, 1980)
3. Help create an "explosion of opportunity" (Rosenfeld, 1980)
4. Increase interagency cooperation (Sullins, 1987)
5. Foster partnership with public agencies (Sullins, 1987)
6. Establish closer ties with the private sector (Sullins, 1987)

Disadvantages

1. Participation has been low in the feeder districts (Rosenfeld, 1980)
2. Areas with strong traditions of local control have not been affected by centers and have in fact have a history of rejecting them (Rosenfeld, 1980)
3. Time needed for transportation is sometimes quite excessive and leaves students no time for either new graduation requirements or extracurricular activities (John Sutter, phone interview 24 May 1988)
4. Students are relunctant to leave their peers for extended amounts of time during the school day (Sutter, 1988)
5. Academic areas often view the regional vocational center as direct competition and regard it as the reason for declining enrollments (Sutter, 1988)

L. RESOURCE SHARING: sharing teachers, equipment between rural schools; sharing other resources with business and industry and institutions of higher learning.

Advantages

1. Can clarify roles and expectations of the resource sharing partnership as a whole and of the partners individually (Wall, 1985)
2. Can establish on-going communications mechanism which forces partners to share information on a regular basis (Wall, 1985)
3. Can provide for periodic evaluation and assessment (Wall, 1985)

Disadvantages

1. Who pays how much; who leads and who follows (Wall, 1985)
2. Scheduling can be a problem if it isn't done efficiently (Sullins, 1980)
3. Complicated bookkeeping responsibilities including keeping track of cost sharing (Sutter, phone interview May 1988)

GENERAL ADVANTAGES OF DISTANCE EDUCATION

Teachers are able to work with more students.
Present courses can be maintained despite declining enrollments.
Classes can be offered at more than one period during the day.
New courses can be introduced easily.
Taping and replaying capabilities.
Eliminates major costs of transporting students and/or teachers.
Eliminates wasted time & scheduling of same.
Better utilizes faculty expertise.
Better serves educational needs of students.
Spirit of cooperation is fostered.
Interdisciplinary communication.
Students gain experience on the equipment.
School events programmed into the system (Siegmund, 1985)

GENERAL PROBLEMS WITH DISTANCE EDUCATION

COMPETITION. How will destructive competition and duplicate course offerings be avoided? Who should produce and deliver which courses? What impact will this have on enrollment, teacher contracts, tuition credits and staffing patterns?

COURSE DEVELOPMENT COSTS. State aid? Instructor prep time? Pay the instructors for extra work? Partnerships with private sector?

EFFECT ON STUDENTS. Should students at remote sites be supervised? What role should an on-site instructor play?

PREPARING TEACHERS. Some teachers are anxious about teaching a remote group. Some are apprehensive about equipment, keeping students' attention. How much in-service is necessary?

Which content areas lend themselves to distance delivery?
How much of courses should be preproduced? How much live?
Do media related resources currently exist?
How can the instruction be humanized?
Student support services?
Are teacher training institutions required? (Dean, 1986)

TENDENCY TO PERMIT THE FASCINATION WITH TECHNOLOGY TO DOMINATE. For example, robotics is only one part of the high tech revolution. And the impact of high tech is not limited to robotics and computers. (Doty, 1987) However, a number of vocational education departments in the U.S. developed demonstration robotics courses which allowed students to become caught up in the "fun" of high tech, and then suddenly realized this wasn't the way to deliver instruction at all. The point is to use robotics to teach mechanics, hydraulics, physics, math, etc. Most departments/districts backed off and dropped the "Robotics" label. The end result in the classes is still to build a robot, but the emphasis is on the integration of many high tech skills and learning modules. (Charles Doty, phone interview May, 1988)

STUDENT FOLLOW-THROUGH. The military did a study on technological programs by correspondence. And it was found that the greater the technology, the greater increase in non-completion by students. The student must be extremely self-motivated and an initiator or the system simply doesn't work. The best answer to the problem, according to Doty, is the development of the Area Vocational Center, located throughout the country, which offer short-term intensified instruction. (Charles Doty, phone interview on May, 1988)

RECOMMENDATIONS

Based on the review of literature, phone interviews and other data collected, it is recommended that the following plans of action, either individually, or in conjunction with one or more alternatives, be adopted:

I. State Programs of Vocational Education must assist the rural programs by doing the following:

-Provide information and if possible, funding.
-Coordinate efforts of varied state projects.
-Determine accreditation for programs.
-Work with universities to give future teachers awareness of new technology in its many forms.
-Alleviate the concern of teachers with regard to the fears connected with learning new technologies.

Without this kind of unified approach, the future of vocational education in rural areas will be in the hands of a very few fractured programs which will likely disappear before the end of the next decade.

II. It is cheaper to transport information than to transport people. And in rural areas, as we have seen, the less expensive the better, especially considering the dwindling tax base, declining enrollments and increasing outmigration in some rural areas. On the basis of the research,

we recommend that a multi district pilot test be undertaken using a satellite network with microcomputer networking. This pilot test should include test sites chosen in conjunction with the Arizona Department of Education and the Arizona Center for Vocational Education, and should be funded by the state.

III. State Programs of Vocational Education should include a comprehensive delivery system which includes as many different forms of media as possible, and which also includes the following modes:

a. Satellite computer based network
b. Microcomputer-Mainframe network
c. Videotaped lessons
d. Interactive video

IV. School Programs of Vocational Education should include: model programs which are customized for the area being served, insofar as possible program replication should also be included in the site selection criteria.

V. School Programs of Vocational Education should include: a strong curriculum development phase before programs are implemented. This will prevent helter-skelter courses and programs which would have little if any effect on meeting Arizona's need for the 1990's and beyond. The curriculum should be competency-based and should be conceptually based and curriculum matrixed utilizing components such as those found in Appendixes A, B, C and D: "Occupational Core Skills," "Related Basic Skills," and "Basic Employability Skills." (Other Appendices are provided to illustrate the cross-over of basic and vocational skills.)

VI. School Programs of Vocational Education should include: continuous research regarding new and emerging technologies and programs. Without this direction, the state's ability to compete will diminish dramatically as the years go on.

VII. Implement A Solid System of Distance Education. According to the research and based on Arizona's particular needs, the most advantageous system is two-way interactive television because of its greater access to information and eventual lead-in to improved programming. However, due to the fact that two-way TV instruction requires more lead time and capital investment, a multi-district trial should be tested over a period of time and then carefully assessed. (Brach 1984) If the districts are not yet capable of investing this large amount of money in distance education, then the second best alternative is Satellite linked with a computer system. Downlink facilities should be placed at a

central location in Arizona, preferably an institution of higher learning, which would facilitate pre-service and in-service training for those teachers that require it. In either case it is important to remember to design a system that is open-ended and allows for future development when technology changes again, which is inevitable.

VIII. Model Programs To Fit Individual Areas. There appears to be no one "best" system. (Hobbs, 1985) Each rural district has its own peculiarities. A predominantly Caucasian rural farming community in Maine will have different needs and potentials than an isolated Navajo reservation in the northeastern corner of Arizona. The needs of each vastly different community must be assessed and dealt with accordingly. No one technological delivery system model will solve all schools problems. (Wall, 1985) The best way to follow through with this recommendation would be to choose a system that allows for flexibility within each district.

IX. Teach Technology, Not Toys. Emphasis on teaching ABOUT computers should be avoided in favor of exploring the potential of this technology for a dynamic and interactional concept of education. (Hobbs, 1985) In other words, the medium is not the message in the case of delivering rural vocational education by distance education. We should not buy fancy equipment and high priced delivery systems that will not be easily adaptable to the future and expanding needs.

In addition, state programs of education should also consider the following:

Establish an 800 number for the system, consortium or center. (Hobbs, 1985)

Hire a basic skills counselor to work with vocational education teachers (Pritz, 1988)

Team Teach. Once-a-week team teaching by vocational and academic teachers (Pritz, 1988)

Teacher Increases. Seek increases in the number of vocational education teachers in rural schools. (Brach, 1984)

Task Force. Create a state-level task force on Rural Education Telecommunications. (Brach, 1984)

Integration with the Community. Vocational education should become an integral part of the total rural development programs. (Edington, 1980)

Looking Toward the Future. If the threads of technology are woven throughout the curriculum, the student will graduate with a working knowledge of the correct uses of technology. (Nytes and Musegades, 1985)

Establish a Technology Advisory Committee. Establish a system of Key Demonstration Resource People. Train the teachers. (Nytes and Musegades, 1985)

CONCLUSION

The next step for Arizona has been to form a statewide task force, chaired by Dr. Charles Losh, Arizona Department of Education, and Dr. Robert V. Kerwood, Director, Arizona Center for Vocational Education. The task force will proceed with the results of this research study and the Arizona Center for Vocational Education will be conducting projects to work with secondary districts and appropriate community colleges for initializing pilot programs.

SPENDING MONEY TO ENSURE WISE USE OF THE TECHNOLOGY IS FAR MORE IMPORTANT THAN SPENDING MORE MONEY ON ADDITIONAL TECHNOLOGY THAT WILL SIT IDLE. (Nytes and Musegades, 1985)

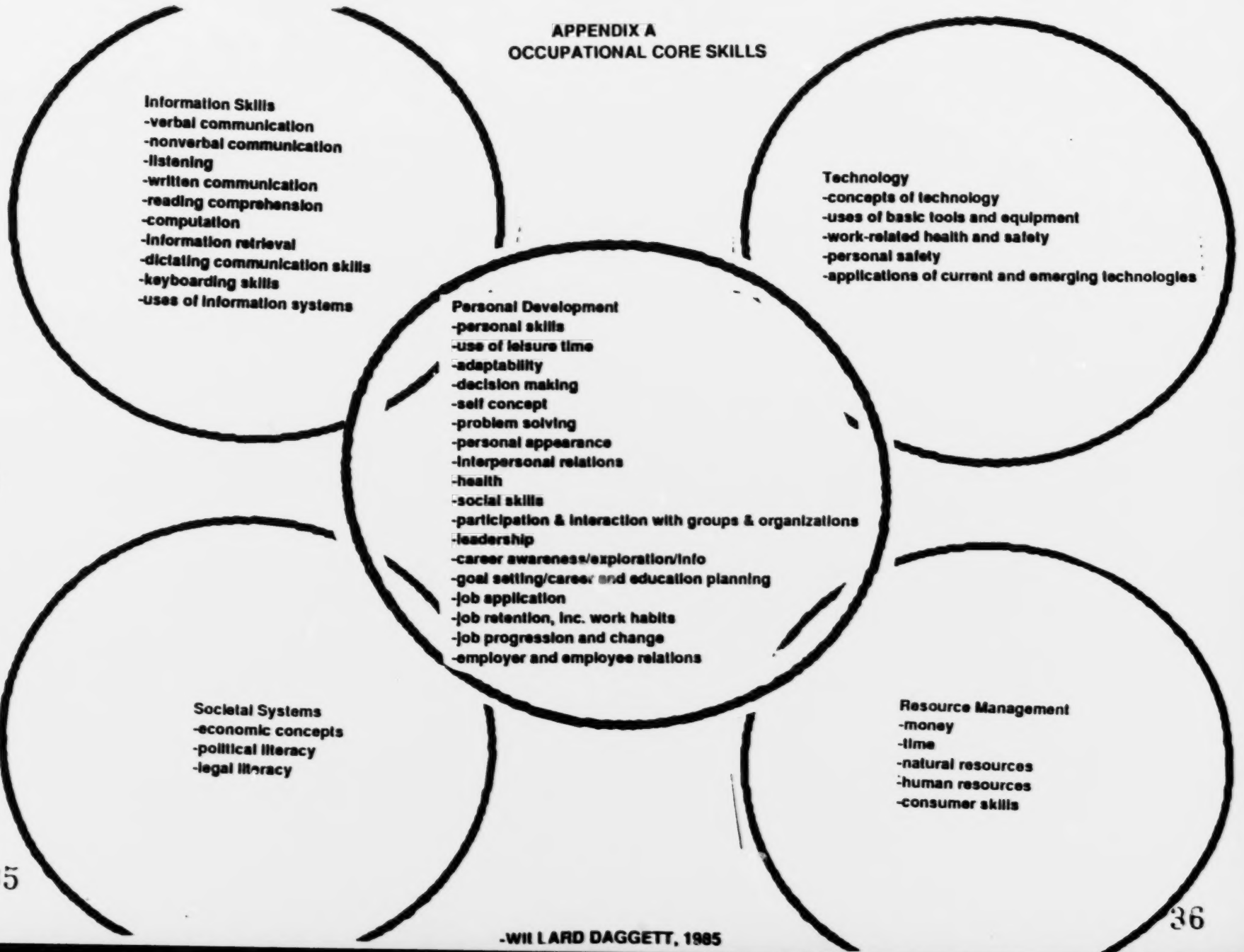
According to Educational Technology Update, March 1987:

> Educational organizations..have long perceived a need to 'restructure the education program, from one based on time allotted to task to one based on mastery of competencies.' Such reform efforts indicate a major need for technological solutions. National productivity, economic development, education, and training are concerns that can be affected by technology if federal, state and private sector activities support organizations willing to take the risk to 'try something new' to teach all children.

The need to "take the risk," to "try something new" is at the very center of the need to reorganize and restructure vocational education in rural areas

If you or your school would be interested in seeing the video presentation of this research report, please contact Melle Starsen at the Arizona Center for Vocational Education, Box 6025 NAU, Flagstaff, Arizona 86011, (602) 523-5442.

APPENDIX A
OCCUPATIONAL CORE SKILLS



-WILLARD DAGGETT, 1985

RELATED BASIC SKILLS **Reading, Writing, Speaking and Listening**

Competency	Air Conditioning/Heating	Allied Health 1	Allied Health 2	Auto Mechanics 1	Auto Mechanics 2	Building & Grounds	Business & Office (Adult)	Business Management	Computer Aided Inst.	Carpentry	Commercial Fisheries	Cosmetology	Data Processing	Data Processing (Adult)	Diesel Mechanics 1	Diesel Mechanics 2	Drafting	Electronics 1	Electronics 2	Machine Tool	Marketing Education	Motorcycle Mechanics	Office Education	Offset Printing	Practical Nursing	Truck Driver Training	Welding
Using Technical Manuals, Catalogs, & Directories	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Applying and Understanding Terminology	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Reading and Understanding Employee Manuals	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Filling out Forms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Job Application and Interview Skills	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Following Oral Directions	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Comprehension of Theory	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Business Letters							●	●	●				●	●									●				
Proofreading Skills & Checking for Accuracy							●						●										●	●			
Read Directions for Operations of Equip/Machinery	●	●	●	●	●					●	●				●	●		●	●	●		●				●	●
Reading Plans and Schematics/Diagrams	●			●	●					●	●				●	●	●	●	●	●		●					●
Blue Print Reading	●									●	●						●			●							●
Evaluation of Written Material	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Computer Literacy Applications	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Technical Writing		●	●				●	●	●		●		●	●			●	●	●		●		●	●	●		
Accurate Composition of Letters/Written Information							●	●	●				●	●			●				●		●	●	●		
Accurate Maintenance of Records & Charts		●	●				●	●				●									●		●	●	●	●	
Inventory Control								●				●	●	●							●				●		
Oral Presentation Skills		●	●				●	●	●			●	●	●			●				●		●	●	●		
Correct Oral and Written Grammar	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Handle Telephone Messages In A Business-like Manner		●	●				●	●	●			●	●	●			●				●		●		●		
Verbal Skills for Sales Promotion								●				●									●		●	●			
Human Relations	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

APPENDIX C

BASIC EMPLOYABILITY SKILLS

Learning to read and write effectively

Learning to communicate simply

Learning to manage information

Learning computer literacy

Learning history

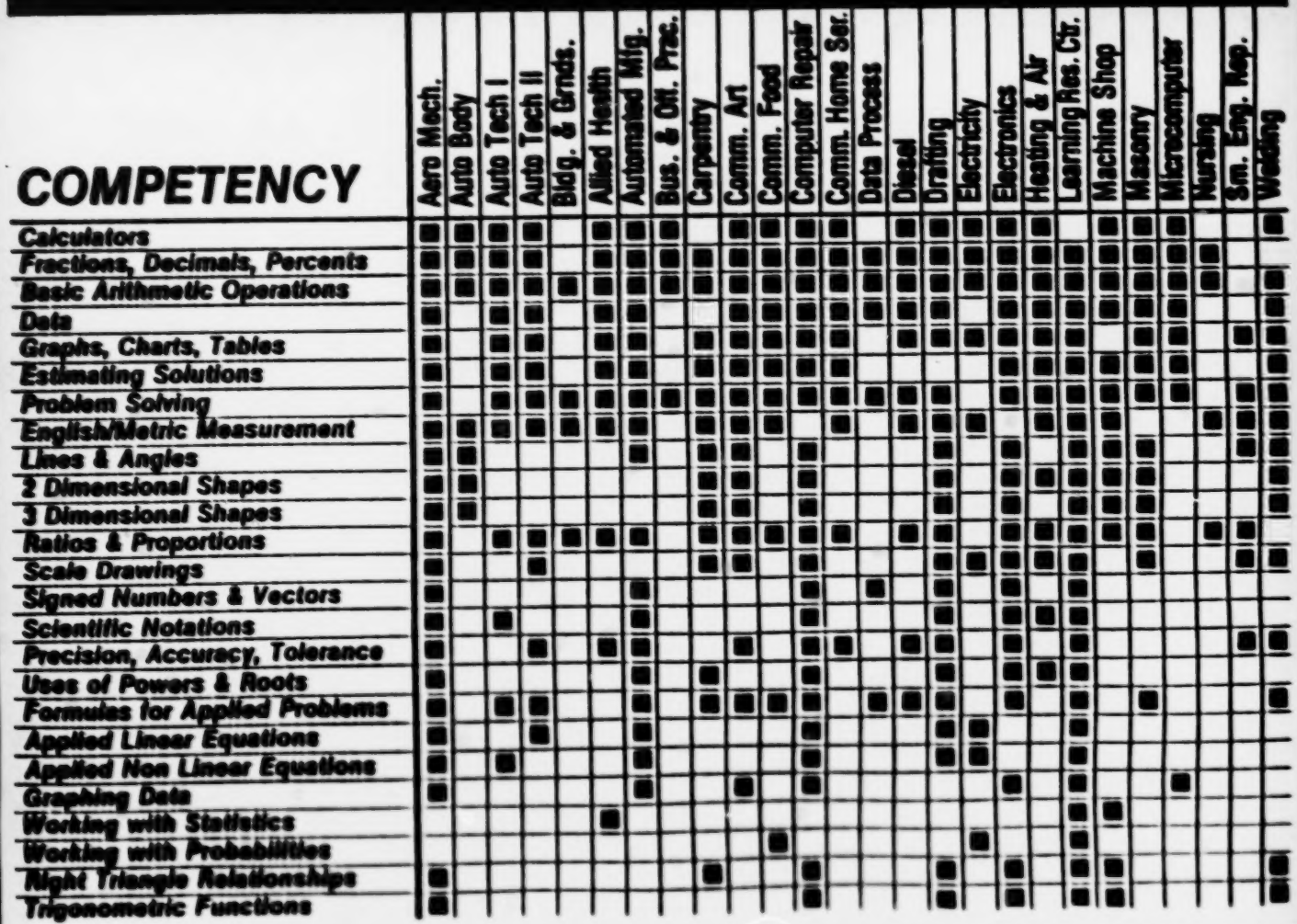
Learning to think

Learning to learn.

-Marvin Cetron, 1984

Tying It All Together

Mathematics - It's Worth It!
Here's How It Works In Real Life.

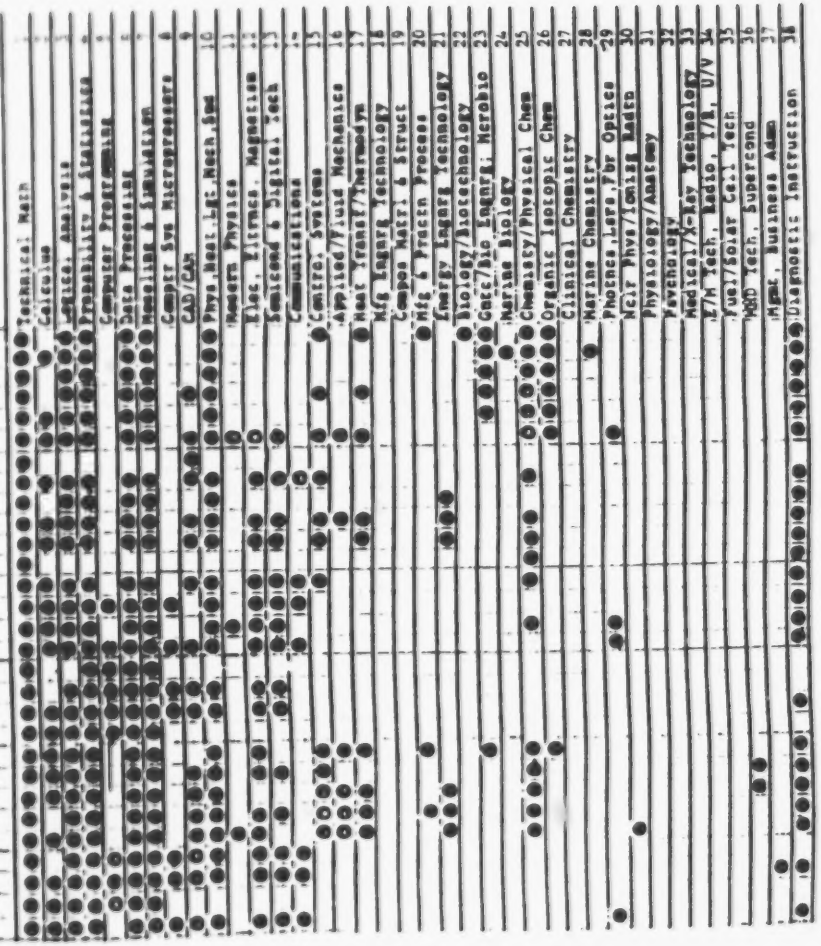


APPENDIX D, cont.

High Technology Matrix - Page 1

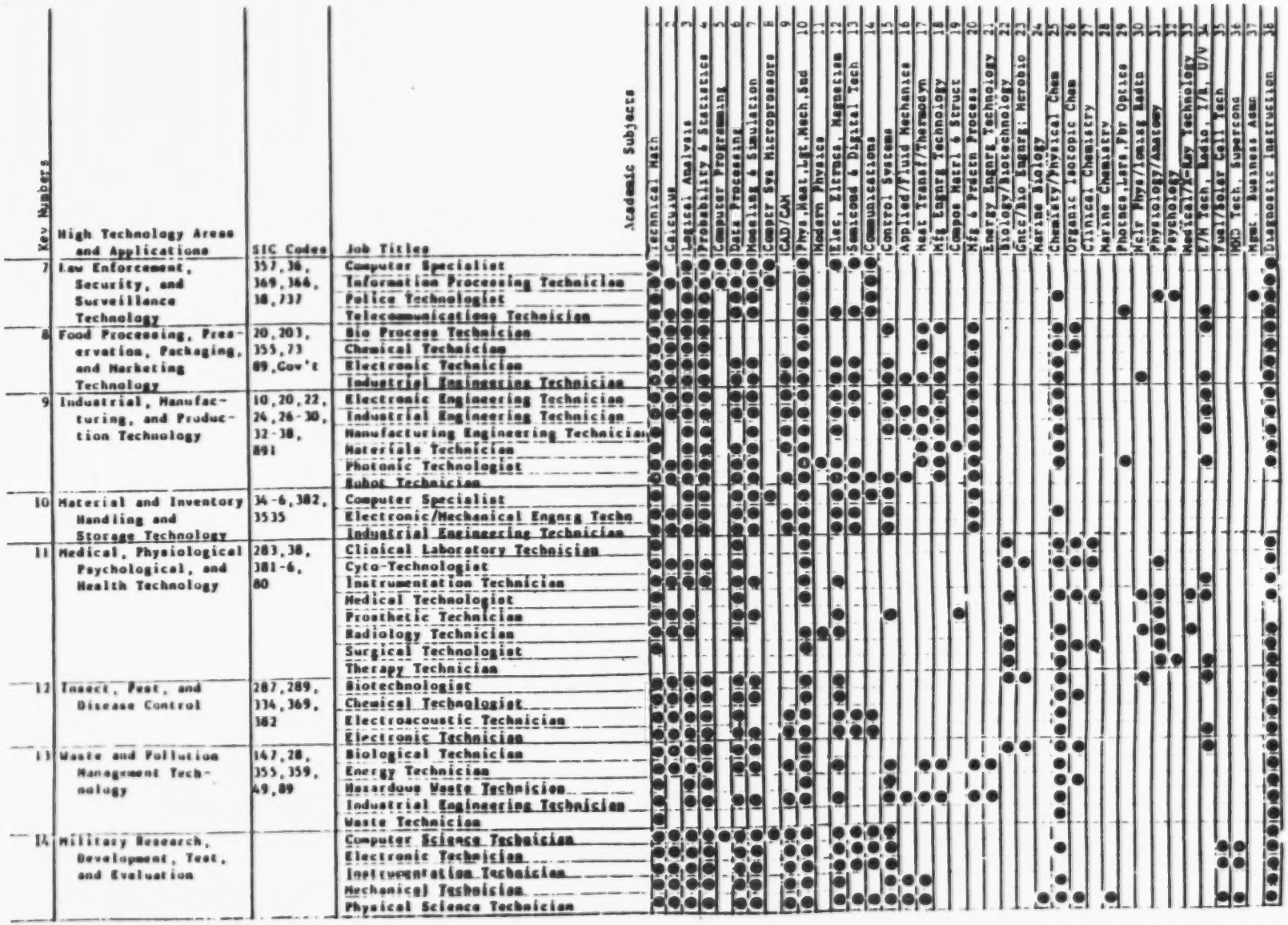
Key Numbers	High Technology Areas and Applications	SIC Codes	Job Titles
1	Bioengineering and Technology	26,28,283, 2834,286, 2861,9, 287,289	Bio Process Technician Bioscience Technician Genetic Engineering Technician Laboratory Technician Microbiology Technologist Science Technician
2	Building Management and Control Technology	17,343,356 36,364-6, 369,382, 3822,734, 89,891	Architectural Technician Electronic Technician Energy Technician Energy Engineering Technician Industrial Engineering Technician Waste Technician
3	Communications, Information Transfer and Entertainment Technology	365-7,369, 79,737	Electronic Technician Information Process Technician Photonic Technologist Telecommunications Technician
4	Computing Technology	357,3573, 366,367, 369,737	Computer Programmer Computer Specialist Computer Systems Analyst Data Processing Technician
5	Energy Management, Conversion, and Control Technology	28,29,35, 36,369	Bio Process Technician Electronic Technician Energy Technician Industrial Engineering Technician Nuclear Engineering Technician
6	Management Systems and Office Automation Technology	36,357,6, 60-7,70,73 737,80-3, 86,89	Computer Specialist Computer Systems Analyst Information Processing Technician Telecommunications Technician

Academic Subjects



APPENDIX D, cont.

High Technology Matrix - Page 2



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